RESEARCH ARTICLE

EFFECT OF PLANT NUTRIENTS AND INSECTICIDES INTEGRATION AGAINST RICE LEAF FOLDER, *CNAPHALOCROCIS MEDINALIS* (GUENEE)

G. Naga Bharani*, K.L. Painkra and Sanjay Sharma

Department of Entomology, College of Agriculture,
Indira Gandhi Krishi Vishwavidyalaya, Raipur – 492012.
Email: bharaniagrico@gmail.com

Received-05.04.2017, Revised-02.05.2017

Abstract: Studies were carried to evaluate the influence of plant nutrients @ 50:30:20kg/ha (50% recommended NPK level), 100:60:40kg/ha (100% recommended NPK level) and 150:90:60kg/ha (150% recommended NPK level) on insecticide toxicity at 24hrs, 48hrs, 72hrs and 96hrs after spray against leaf folder, *Cnaphalocrocis medinalis* (Guenee) in *kharif* 2015 and 2016. Among the tested insecticides, Rynaxypyr 18.5%SC and Cypermethrin 25%EC recorded the highest percent mortality followed by Fipronil 5%SC, Monocrotophos 36%SL. Moderate toxicity was recorded by Imidacloprid 17.8%SL and Acephate 75%SP. Under different nutrient levels *i.e.*, 50%, 100% and 150%NPK leaf folder mortality was not affected in treatments Rynaxypyr 18.5%SC (90.83, 87.50 and 86.67% in *kharif* 2015; 90.00, 87.50 and 87.50% mortality in *kharif* 2016) and Cypermethrin 25%EC (85.00, 84.92 and 83.33% in *kharif* 2015; 83.00, 83.00 and 82.67% mortality in *kharif* 2016). Toxicity of Monocrotophos 36%SL (77.50, 71.67 and 66.67% mortality; 75.83, 71.67 and 67.50% mortality in *kharif* 2015 and 2016, respectively) was affected moderately with change in plant nutrition levels. Mortality of leaf folder in treatments Fipronil 5%SC (83.33, 74.17 and 65.00% mortality; 84.17, 74.17 and 65.83% mortality in *kharif* 2015 and 2016, respectively), Imidacloprid 17.8%SL (65.00, 56.67 and 48.33% mortality; 65.00, 58.33 and 49.17% mortality in *kharif* 2015 and 2016, respectively) and Acephate 75%SP (66.67, 58.33 and 50.83% mortality; 67.50, 57.50 and 50.83% mortality in *kharif* 2015 and 2016, respectively) were highly affected by different NPK levels *i.e.*, 50%NPK, 100%NPK and 150%NPK.

Keywords: Host plant nutrition, NPK levels, Insecticides, Rice leaf folder

INTRODUCTION

The rice crop provides food to more than half of the world's population and host to over 800 species of insect herbivores from nursery to harvest but only a few of them are of potential threat and have gained the major importance as far as loss in yields caused by them are concerned. Even though, there are many constraints in rice production, insects' pests remain a constant problem in all the rice growing regions (Manikandan Narayanasamy *et al.*, 2014). The rice leaf folder, Cnaphalocrocis medinalis (Guenee) once considered as minor pest has gained the status of an important pest. Bautista et al. (1984) reported that at 17.5% damaged leaves the yield loss was 16.5%, whereas at 26.6% damaged leaves it was 21.3%. Changes in the physical environments, cultural practices, multiple cropping patterns, reduced genetic variability of high yielding rice varieties, application of high levels of nitrogenous fertilizer and prophylactic use of pesticides are the major reasons of the leaf folder problem (De Kraker *et al.*, 2000). Reports also show that severe infestation of this pest leads to as high as 23.3% leaf damage (Ahmad et al., 2010) and causes significant yield loss. Nutrition management is one of the most important practices for high production system, but nutrition management may affect response of rice to pests, as well as development pattern of pest populations. The information on uptake of nutrients by the crop due to combined application of major plant nutrients NPK at different doses and rice varieties with differential susceptibility to pest under insecticidal protection is inadequate. Previous studies have demonstrated that host plant affects the susceptibility of insects to pesticides. The use of induced resistance through application of nutrients has been known to have tremendous potential in curtailing the insect pest populations. Previously studies taken up to know the effect of insecticides under different nutrition levels against rice leaf folder and green leaf hopper at field level by Dash (2008). But studies have not explained what will be effect of plant nutrition levels on insecticide toxicity at constant population levels. Hence the study been taken up to know exact toxicity change of insecticides at different NPK levels against rice leaf folder.

*Corresponding Author

MATERIAL AND METHOD

Pot culture studies were conducted during *kharif* 2015 and 2016 in factorial CRD at glass house, college of agriculture, IGKV, Raipur. The treatments comprised of 3 nutrient levels, 50:30:20kg/ha (50%NPK level), 100:60:40kg/ha (100%NPK level) and 150:90:60kg/ha (150%NPK level); and 6 insecticide treatments, Monocrotophos 36%SL@ 2.5ml/lit (T1), Acephate 75%SP@ 1.2g/lit (T2), Cypermethrin 25%EC@ 0.3ml/lit (T3), Imidacloprid 17.8%SL@ 1.6ml/lit (T4), Fipronil 5%SC@ 1.1ml/lit (T5), Rynaxypyr 18.5%SC@ 0.3ml/lit (T6) and control (T7) pot. Rice variety 'Mahamaya' were selected for the experiment. Experiment was replicated thrice.

Rearing rice leaf folder on different plant nutrition levels

Larvae of rice leaf folder reared on rice variety Mahamaya grown under different fertilizer levels *i.e.,* from 50%NPK, 100%NPK and 150%NPK. Small plastic pots were filled with soil from respective fertilizer regimes at LTF site and rice variety Mahamaya was grown for 30 days which were used for experiment and larval rearing. Adults of leaf folder were collected from the field by sweep net or by test tubes under lights at night times and released onto plants grown on different fertilizer levels. Adult moths are given with 10% sucrose solution along with Vitamin-E for increasing the fecundity of females. Larvae was continuously grown on respective fertilizer levels *i.e.,* from 50%NPK, 100%NPK and 150%NPK for 3- 4 generations was used for the study. New plants with soli from respective fertilizer regimes collected from LTF site was provided for continuous food supply to larvae.

Observation to be recorded

Rice variety Mahamaya were gown in plastic pots under different fertilizer levels *i.e.,* 50%, 100% and 150%NPK, was treated with recommended doses of respective insecticide. Larvae reared on different plant nutrition levels *i.e.,* 50%, 100% and 150%NPK were released and recorded mortality percent at 24hrs, 48hrs, 72hrs and 96hrs. For every observation new larvae were released on to insecticide treated plant and covered with plastic covers. Each replication was provided with ten larvae and experiment replicated thrice.

RESULT AND DISCUSSION

The results revealed that in *kharif* 2015 and 2016 among the tested insecticides, highest leaf folder mortality percent was recorded in treatments Rynaxypyr 5%SC (88.33 and 88.33% mortality) and Cypermethrin 25%EC (88.42 and 88.33 % mortality) followed by Fipronil 5%SC (74.17 and 74.12%) and Monocrotophos 36%SL (71.94 and 71.96%) recorded moderate percent mortality. Treatments Imidacloprid 17.8%SL (56.61 and 57.50%) and Acephate 75%SP (58.61 and 58.61%) recorded lower leaf folder mortality. The results are in accordance with Chanu and Sontakke (2015) who reported Rynaxypyr 0.4G found most effective in reducing the damage (80.27 and 86.12% reduction over control) percent followed by Fipronil 0.3G (71.48 and 80.49% reduction over control). Similar report given by Dhaka *et al.* (2012) that treatment with Fipronil 5%SC recorded higher leaf folder reduction compared to other treatments. The results also revealed that integration of plant nutrients at varied levels affecting toxicity of some insecticides. The data at 24hrs and 48hrs in *kharif* 2015 and 2016 showed that the toxicity of all the insecticides had no significant effect at different NPK levels *i.e.,* 50%NPK, 100%NPK and 150%NPK. The toxicity of some insecticides like Acephate 75%SP, Imidacloprid 17.8%SL and Fipronil 5%SC are affected with plant nutrient levels at 72hrs and 96hrs after spray (Table 1 and 2). At 72hrs after spray leaf folder mortality was highly affected by plant nutrition levels in treatment Fipronil 5%SC which recorded 83.33, 70.00 and 56.67% mortality in *kharif* 2015; 86.67, 70.00 and 56.67% mortality in *kharif* 2016 followed by Imidacloprid 17.8%SL with 63.33, 53.33 and 40.00 mortality in *kharif* 2015; 63.33, 50.00 and 40.00 mortality in *kharif* 2016 under different NPK levels *i.e.,* 50%NPK, 100%NPK and 150%NPK, respectively. Acephate 75%SP recorded 63.33, 56.67 and 43.33 mortality in *kharif* 2015; 66.67, 53.33 and 43.33 mortality in *kharif* 2016. The results are in accordance with Dash (2008) who conducted field experiment on effect of plant nutrients in response to insecticides against rice leaf folder, *Cnaphalocrocis medinalis* and revealed that the effectiveness of triazophos was more pronounced in nutrient level 60:30:30 kg NPK/ha in minimizing the leaf folder incidence (9.32% leaf infestation) at peak activity of pest than any other treatment combinations.

At 96hrs after spray leaf folder mortality was highly affected by plant nutrition levels in treatment Fipronil 5%SC which recorded 76.67, 66.67 and 56.67% mortality in *kharif* 2015; 73.33, 66.67 and 53.33% mortality in *kharif* 2016 followed by Imidacloprid 17.8%SL with 50.00, 40.00 and 30.00 mortality in *kharif* 2015; 53.33, 43.33 and 30.00 mortality in *kharif* 2016 under different NPK levels *i.e.,* 50%NPK, 100%NPK and 150%NPK, respectively. Acephate 75%SP recorded 50.00, 40.00 and 33.33 mortality in *kharif* 2015; 53.33, 43.33 and 30.33 mortality in *kharif* 2016. Similar reports are given by Dash *et al.,* 2008 against gall midge, *Orseolia oryzae* under field condition which revealed greater compatibility of nutrient dose 60:30:30 kg NPK/ha + ZnSO4 with granular fipronil in arresting the silver shoot (SS) incidence to a appreciable level (3.01% SS) at peak activity of the pest than other treatment combinations. From the entire investigation insecticides with systemic toxicity like Fipronil and Imidacloprid was highly affected due to different NPK levels compared to contact and stomach action insecticides like Cypermethrin and Rynaxypyr. The semi systemic insecticide like Monocrotophos and residual systemic insecticide like Acephate toxicity was moderately affected.

Table 1. Effect of plant nutrients and insecticides integration against rice leaf folder *Kharif* 2015

Treatments	Percent leaf folder mortality*											
	24hrs			48hrs			72hrs			96hrs		
	50% NPK	100% NPK	150% NPK	50% NPK	100% NPK	150% NPK	50% NPK	100% NPK	150% NPK	50% NPK	100% NPK	150% NPK
T1	90.00 (64.82)	86.67 (61.92)	86.67 (60.48)	80.00 (53.91)	76.67 (50.23)	70.00 (44.81)	76.67^{cA} (51.39)	66.67^{cB} (41.91)	60.00^{cB} (37.1)	63.33^{cA} (39.39)	56.67^{dAB} (34.58)	50.00^{cB} (30.15)
T2	76.67 (50.23)	73.33 (48.48)	66.67 (42.52)	73.33 (47.33)	66.67 (41.91)	60.00 (37.1)	66.67^{dA} (42.29)	53.33^{dB} (32.29)	43.33^{dC} (25.97)	50.00^{dA} (30.15)	40.00^{eAB} (23.68)	33.33^{dB} (19.66)
T3	93.33 (68.49)	96.67 (72.83)	96.67 (72.83)	90.00 (69.1)	86.67 (60.48)	86.67 (61.92)	83.33^{bcA} (56.81)	80.00^{bA} (53.13)	80.00^{bA} (53.91)	73.33^{bA} (48.48)	76.33^{bA} (50.23)	70.00^{bA} (44.81)
T4	76.67 (50.23)	73.33 (48.48)	70.00 (44.81)	70.00 (44.81)	60.00 (37.1)	53.33 (32.29)	63.33^{dA} (39.39)	53.33^{dB} (32.67)	40.00^{dC} (23.68)	50.00^{cA} (30.15)	40.00^{eB} (23.68)	30.00^{dB} (17.52)
T5	90.00 (64.82)	83.33 (56.81)	83.33 (57.58)	83.33 (57.58)	76.67 (51.39)	66.67 (42.52)	83.33^{bA} (57.58)	70.00^{cB} (44.81)	56.67^{cC} (34.81)	73.33^{bA} (48.48)	66.67^{cA} (42.52)	53.33^{cB} (32.44)
T6	96.67 (72.83)	96.67 (72.83)	93.33 (68.49)	90.00 (64.82)	83.33 (56.81)	83.33 (57.58)	90.00^{aA} (64.82)	86.67^{aA} (60.48)	86.67^{aA} (60.48)	83.33^{aA} (56.81)	83.33^{aA} (56.81)	83.33^{aA} (56.81)
T7	6.67 (4.3)	6.70 (4.3)	13.30 (7.67)	6.67 (4.3)	10.00 (5.74)	13.30 (7.67)	10.00^{eA} (5.74)	10.00^{eA} (6.24)	6.70^{eA} (4.30)	10.00^{eA} (6.24)	6.70^{fA} (4.3)	13.30^{eA} (7.67)
Sed±	4.34			4.95			3.08			3.25		
CD (0.05)	N.A			N.A			6.21			6.56		
CV (%)	10.66			11.36			13.12			14.47		

* Mean of three replications; Figures in parentheses are arc sine transformed values;
In a column, means followed by a common small letter(s) between the treatments are not significantly different by CD (P=0.05);
In a rows, means followed by a common large letter(s) between NPK levels within treatment are not significantly different by CD (P=0.05).

Table 2. Effect of plant nutrients and insecticides integration against rice leaf folder *Kharif* 2016

Treatments	Percent leaf folder mortality*											
	24hrs			48hrs			72hrs			96hrs		
	50% NPK	100% NPK	150% NPK	50% NPK	100% NPK	150% NPK	50% NPK	100% NPK	150% NPK	50% NPK	100% NPK	150% NPK
T1	90.00 (64.82)	86.67 (61.92)	86.67 (60.48)	80.00 (53.91)	76.67 (50.23)	73.33 (47.33)	70.00^{cA} (44.81)	66.67^{cAB} (41.91)	60.00^{bB} (37.10)	63.33^{cA} (39.39)	56.67^{cA} (34.58)	53.33^{cA} (32.44)
T2	76.67 (50.23)	70.00 (44.81)	66.67 (42.52)	76.67 (50.23)	73.33 (47.33)	66.67 (42.29)	66.67^{cA} (42.29)	53.33^{dB} (32.29)	46.67^{cB} (28.11)	50.00^{dA} (30.15)	40.00^{dAB} (23.68)	30.00^{dB} (17.52)
T3	93.33 (68.49)	96.67 (72.83)	96.67 (77.11)	86.67 (66.2)	86.67 (60.48)	86.67 (61.92)	80.00^{bA} (53.91)	80.00^{bA} (53.13)	80.00^{aA} (53.91)	73.33^{bA} (48.48)	70.00^{bA} (44.81)	70.00^{bA} (44.81)
T4	76.67 (50.23)	73.33 (48.48)	73.33 (47.33)	70.00 (44.81)	63.33 (40.00)	60.00 (37.1)	63.33^{cA} (40.00)	50.00^{dB} (32.67)	40.00^{cB} (23.68)	53.33^{cdA} (32.67)	43.33^{dB} (25.72)	30.00^{dC} (17.52)
T5	90.00 (64.82)	83.33 (56.81)	83.33 (57.58)	86.67 (60.48)	76.67 (51.39)	73.33 (47.33)	86.67^{abA} (60.48)	70.00^{cB} (44.81)	56.67^{bC} (34.81)	76.67^{bA} (51.39)	66.67^{bB} (42.52)	56.67^{cC} (34.58)
T6	96.67 (72.83)	96.67 (72.83)	96.67 (72.83)	90.00 (64.82)	83.33 (56.81)	83.33 (57.58)	86.67^{aA} (61.14)	86.67^{aA} (60.48)	86.67^{aA} (60.48)	86.67^{aA} (61.92)	83.33^{aA} (56.81)	83.33^{aA} (56.81)
T7	10.00 (5.74)	10.00 (5.74)	13.30 (7.67)	6.67 (4.3)	10.00 (5.74)	13.30 (7.67)	13.33^{dA} (7.67)	16.67^{eA} (9.60)	13.33^{dA} (7.67)	16.67^{eA} (9.60)	16.67^{eA} (9.60)	16.67^{dA} (11.54)
Sed±	4.19			3.61			3.57			3.75		
CD (0.05)	N.A			N.A			7.21			7.56		
CV (%)	11.01			9.25			10.16			11.34		

* Mean of three replications; Figures in parentheses are arc sine transformed values;
In a column, means followed by a common small letter(s) between the treatments are not significantly different by CD (P=0.05);
In a rows, means followed by a common large letter(s) between NPK levels within treatment are not significantly different by CD (P=0.05).

REFERENCES

Ahmad, Hafeez, Khan, R.B., Sharma, Devender, Jamiwal, V.V.S. and Srivastava, Kuldeep (2010). Assessment of yield infestation relationship of Cnaphalocrosis medinalis in rice. *Annals of Plant Protection and Sciences*, **18:** 489-490

Bautista, R.C., Heinrichs, F.A. and Rejesus, R.S. (1984). Economic injury levels for the rice leaf folder, Cnaphalocrocis medinalis (Lepidoptera: Pyralidae): Insect infestation and artificial leaf removal. *Environmental Entomology*, **13:** 439-443.

Chanu, N.Y. and Sontakke, B.K. (2015). Comparative Efficacy Of Chlorantraniliprole And Emamectin Benzoate Against Rice Leaf Folder. *Indian Journal of Entomology*, **77(3):** 221 -225.

Dash, D. (2008). Influence of plant nutrients on effectiveness of insecticides against rice leaf folder, *C. medinalis* (Guenee). *Journal of Plant Protection and Environment*, **5**(2):158-161.

Dash,D., Mishra, P.R. and Sarangi, P.K. (2008). Influence of graded levels of plant nutrient on the effectiveness of insecticides against rice gall midge, *O. oryzae* (Wood-Mason). *Environment and Ecology*, **26(3A):** 1273-1275.

De, Kraker, Rabbinge, R, van, Huis, A, van, Lenteren, J. C. and Heong, K. L. (2000). Impact of Nitrogenous-fertilization on the population dynamics and natural control of rice leaf folders (Lepidoptera: Pyralidae), *International Journal of Pest Management* **46:** 225-235.

Dhaka, S.S., Singh, G., Yadav, A., Ali, N. and Singh, D.V. (2012). Evaluation of some novel insecticides against rice leaf folder, *Cnaphalocrocis medinalis* (Guenee). *Progressive Agriculture*, **12(2):** 360-364.

Manikandan, Narayanasamy, John, Samuel Kennedy and Geethalakshmi, Vellingiri (2014). Life History And Population Dynamics Of Rice Leaf folder at Different Temperatures. *The Ecoscan* **8(3&4):** 315-320.